

Application of The Analytic Hierarchy Process (AHP) to Analyze Industries Risk Management in Metal Casting Industries

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Abstract

The purpose of this study is to identify possible risks within the Company and then create a risk matrix to determine the worst risks to be prioritized in control. This research was conducted on business owners and staff of metal casting companies members of Batur Jaya Industrial Cooperative Ceper Klaten using the Analytic Hierarchy Process (AHP) approach by focusing on strategic risks, operational risks, reporting risks, and corporate regulatory risks. The findings of the study resulted in form risks identification show that there are 38 risks that may occur within the Company. The calculation of the assessment of eaRisk is based on the weighting of each risk, then calculated the eigenvalue. The risk needs to be prioritized to be controlled and immediately corrected by the Company is strategic risk with a percentage of 51%. Meanwhile, the alternatives need to be considered and improved are improving the quality of service, the consistency of the Company in meeting the needs of consumers, information, and tax regulation.

Keyword risk, risk management, analytic hierarchy process, eigenvalue



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I. INTRODUCTION

The condition of the business world is always fraught with uncertainty (Hanafi, 2009). Risk comes unexpectedly and is difficult to avoid. The Company needs to take the initiative to manage the risks that are expected to emerge as best as possible. If the Company is not able to manage these risks properly, then the Company is Risk of receiving losses. Darmawi (1990), Djojosoedarso (2003), Hanafi (2009), and Siahaan (2009) stated that the risk is uncertainty that arises in the activities of an organization that can hinder the achievement of the organization's goals, and may even result in the destruction of the organization even if the Risk also provides an advantage.

Uncertainty is inevitable in the business world and will have a huge impact on companies or individuals. The risks that arise within the Company will occur in the internal and external environment of the Company. In addition, the risks that arise in the Company are not only one or two risks, but are very diverse, for example, financial, human resources, production, competition, occupational health, and safety. With the variety of risks that may occur in a company, therefore

the need to be done management and risk control so that the Company can maintain and develop its business, especially in times that have the potential of very tight competition as it is today. One way to manage and minimize the impact of risk is to implement risk management.

II. LITERATURE REVIEW

II.1. Risk Management

Risk is the possibility of events that could harm the Company. A risk is essentially an event that negatively impacts the Company's goals and strategies. The likelihood of risks and consequences to the business is fundamental to be identified and measured. Risk definition, according to Kasidi (2010), is the deviation possibility from the Company's expectation that can cause losses. Identification of hazard, Risk related to such hazard analysis and evaluation are parts of risk assessment. Risk assessment began with making a description problem or a risk question. Once the risk question is well defined, the right risk management tools and types of information that will answer risk questions will be easier to identify. Risk assessment is conducted by the companies to manage and ensure workers are safe and comfortable at the workplace. The risk assessment goal is to make hazards identification so that action can be taken to eliminate, reduce, or control before an accident could cause more severe injury or damage. According to Darmawi (2006), risk management is an attempt to recognize, examine, and control Risk in the activity of the Company to obtain higher effectiveness and efficiency.

Sutanto (2013) defines risk as to the possibility and severity of an event combined. There are various factors determining risk amounts, such as business disclosure, place, user, size, and vulnerability of the elements involved. While Djohanputro (2006) categorized the Risk of the Company into four types:

1. Financial Risk is fluctuations in financial targets or the monetary size of companies due to macro variable volatility.
2. Operational Risk is a risk that can come from internal or external companies where all risks are associated with fluctuations in the business results due to the influence of matters related to system failures or supervision and uncontrollable events.
3. Strategic Risk is a risk that can affect corporate and strategic exposure as a result of strategic decisions that are incompatible with the external and internal environment of the business.
4. External Risk, i.e., potential deviation of results in corporate and strategic exposure and can have an impact on potential business closures due to the influence of external factors.

The goal of risk management implementation is to reduce the different risks associated with the field that has been selected at a level that can be accepted. The environment, technology, people, organization, and politics can cause various threats. Risk management entities such as human resources and organizations should be involved in risk management implementation.

II.2. Analytic Hierarchy Process (AHP)

Saaty (1980) developed a measurement method called The Analytic Hierarchy Process (AHP) to formulate and analyze decisions. The AHP is a decision support tool that can be used to solve complex decision problems taking into account tangible and intangible aspects. By involving many experiences, skills, knowledge, and intuition of the researcher, the method easily supports the users in making decisions.

For many years, the analytic hierarchy process (AHP) is considered as a quite useful and effective tool to make a multi-objective problem structure and model. This method has been applied in many

forms to help to make the business decisions (Liberatore et al., 1992), selection of areas of research and development programs (Elkarmi,1993), real estate investments (Saaty, 1980), water policies (Al Jayousi and Shantanawi (1995), and water desalination technologies (Akash et al., 1997). In the AHP method, the form of a hierarchy of references is evaluated through pairwise comparison series of relative criteria, which are able to help the decision-makers to make a better option. Pairwise comparison can determine the relative weights.

Researchers should understand the basic principles of the AHP to help them solve their problems, which are: (1) Decomposition, to solve or divide the problem into elements and into an interconnected decision-making process hierarchy form; (2) Comparative Judgement, which is an assessment of the relative importance among the elements at a certain level. The assessment result is presented in a matrix pairwise comparisons. From the lowest level up to the highest (extreme importance); (3) Synthesis of Priority can be conducted to gain relative weight by using eigenvector method; (4) Logical Consistency, which can be achieved by summed all vector eigen obtained from different levels of hierarchy and then subsequently obtained a weighted composite vector that results in a decision-making sequence.

There are several steps to make a decision using the AHP method. First is to define the problem, then develop a hierarchical framework/structure, construct a pairwise matrix. Data collected then synthesized and normalized by dividing the value of each element, followed by checking the consistency. Conduct prior steps for all levels in the hierarchy and develop priority ranking and select the best alternative from the priority ranking.

III. RESEARCH METHODOLOGY

Data collection was conducted through surveys and interviews with the business owner and staff with expertise in this work to know the problems with the business in-depth, as well as literature studies. Data collection techniques through literature studies are conducted by studying references and prior researches. Research data was obtained from members of Batur Jaya Ceper Klaten Industrial Cooperative. From the literature, the study obtained a list of possible hazards in metal casting companies along with prevention, and what types of handling can be done. From surveys and interviews, risk categories and weights were obtained from the risk group. In addition, it will be known as prevention and handling chosen by experts regarding metal casting work.

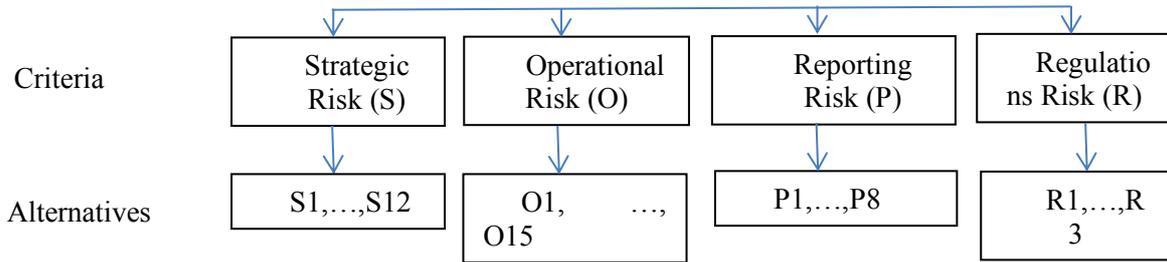
IV. FINDING AND DISCUSSION

The metal casting industry in Ceper Klaten is used as a research object in this study. This research is focused on how to make decisions to provide the best solutions in the form of alternatives that should be prioritized to minimize the Company's business risk. The AHP method is used to analyze the business risk of the Company in this study because it is more structured, easy to understand, and was proven successful as an analytical tool in decision making. The stages of the AHP method are generally based on three stages: goal determination, determination of criteria that affect the objectives as well as various alternatives of each criterion by means of risk assessment by weighting. This research tree diagram with the AHP method is shown in Figure 1.



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Based on the literature of the review that has been conducted, criteria obtained along with alternatives that have an influence on the business risk of the Company. The criteria that affect the Company's business risk in this study, and its symbols are strategic Risk (S), operational Risk (O), reporting risk (P), and regulator Risk (R). Based on surveys and interviews conducted at various metal casting companies, alternatives to each of the criteria affecting business risk are shown in Table 4, while the paired matrices of each weighted criteria are shown in Table 2.

Table 2. Matric pairing of criteria and risk weighting

Criteria	Strategic (S)	Operational (O)	Reporting (P)	Regulation (R)
Strategic (S)	1	3	3	5
Operational (O)	0,333333333	1	2	4
Reporting (P)	0,333333333	0,5	1	3
Regulation (R)	0,2	0,25	0,333333333	1
Total	1,866666667	4,75	6,333333333	13

Based on the data in Table 2, further processing is carried out to obtain the eigenvalue. Processing is done by squalling the criteria matrix, summing the values of each column, and normalizing the values on the matrix. The eigenvalue of each criterion after normalization is shown in Table 3, while the weighting value of each alternative of each criterion after normalization is shown in Table 4.

Table 3. Eigenvalue of Each Criterion After Normalization

Criteria	Strategic (S)	Operational (O)	Reporting (P)	Regulation (R)	Eigenvalue
Strategic (S)	0,535714286	0,631578947	0,473684211	0,384615385	0,506398207
Operational (O)	0,178571429	0,210526316	0,315789474	0,307692308	0,253144881
Reporting (P)	0,178571429	0,105263158	0,157894737	0,230769231	0,168124639
Regulation (R)	0,107142857	0,052631579	0,052631579	0,076923077	0,072332273
Total	1	1	1	1	1

Table 4. Criteria and Alternatives in Business Risk

Criteria	Alternatives		Eigenvalue
	S1	Disruption of the availability and data quality impairs the value of the services.	0.201833016

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Strategic Risk (S)	S2	Dramatic shifts or regulations from the onset of technology cannot be capitalized.	0.140248822
	S3	Damaging prices in the metal casting industry could threaten compliance with the Company's top priorities.	0.168742538
	S4	Poor integration management threatens fulfillment of the Company's top priorities.	0.104593394
	S5	Significant exposure of sensitive data entrusted to the Company's concerns to uncover security flaws or outside intrusions	0.081707593
	S6	Major disasters threaten the Company's ability to maintain security.	0.07489115
	S7	Unpredictable actions from competitors threaten the Company.	0.062779441
	S8	Unpredictable changes in the market threaten the Company.	0.053333085
	S9	The presence of competitors could threaten the Company's position.	0.0394858
	S10	Opposing social or political actions (including terrorism) have a huge impact on the metal casting.	0.034537279
	S11	Incomplete process and less accountable risk management affect the company goal to fulfill	0.02094788
	S12	Failure of products or services threatens the Company's ability to maintain customer satisfaction.	0.016900001
	Operational Risk (O)	O1	The Company's process does not meet customer expectations.
O2		Unfavorable cost of capital and profit margin is generated by the current practice of less resource capacity.	0.131365864
O3		Irrelevant and/or unreliable information may reduce the ability of decision making.	0.151837837
O4		Inconsistent messages are produced by ineffective communication with authorized responsibilities.	0.094472925
O5		Unrealistic, misunderstood, subjective performance measures cause an inconsistent action.	0.072263739
O6		The Company's ability to react to changes affected by the structure of the organization negatively	0.070919926
O7		Outside parties will not act within the limits of the intended authority caused by the failure of the Company to manage outsourcing activities.	0.060024753
O8		Irrelevant and/or unreliable information will result in an unfavorable contract.	0.054388666
O9		The inability of the Company to design a sound business affected by the failure to build an effective and efficient operation and process	0.044462528
O10		The physical and nonphysical security for a good work environment is not provided by the Company.	0.038068148
O11		The goal achievement is threatened by severe training and skills, knowledge, lack of career opportunities of key Companies.	0.032760257
O12		Competitive advantage or returns of the firm are not built and maintained by the resource allocation process.	0.026594699
O13		Deliberate mix serving of financial information or assets fraud affects the good reputation of the Company.	0.021941767
O14		The assets of the Company are used for unauthorized or unethical purposes.	0.016026484
O15		The Risk that ineffective lines of authority cause managers or employees to do things they should not have done	0.013370271

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Reporting Risk (P)	P1	Information is distributed in a way that allows its use for unintentional or irrelevant purposes.	0.283713302
	P2	The Company is faced with actual losses/opportunity costs.	0.186765415
	P3	The Risk that the Company is exposed to financial losses obligations.	0.155062166
	P4	The Risk that the Company's processes do not effectively ensure funds will be used to benefit the Company	0.104931343
	P5	Incomplete and/or inaccurate information contributes to inappropriate business decisions.	0.104826848
	P6	The Risk that the system is vulnerable to manipulation	0.074365068
	P7	The Risk that budgets and business plans are not really accepted by key managers.	0.055131399
	P8	The Risk that systems and processes do not sufficiently protect information access	0.035204459
Regulation Risk (R)	R1	Noncompliance with requirements and tax regulations	0.537373737
	R2	Laws/regulations changes or lawsuit claims result in a reduction in the firm's ability to operate a business efficiently.	0.268013468
	R3	Discrepancies with current laws and regulations subject companies to sanctions and penalties and threaten the Company.	0.194612795

Based on the eigenvalue of each alternative on each criterion, the most important alternatives for the improvement of risk management are S1, O3, P1, and R2. To ensure the decision obtained is valid, the AHP method calculated the consistency ratio (CR) value. The CR value in this study is 0.056601395 because the cr value of < 0.1 , then correspondent preference is consistent, and strategic risk criteria are the most important Risk that risk management should do immediately. The order of risk management criteria to be carried out based on the above AHP analysis is Strategic Risk (50.63%), Operational Risk (25.31%), Report Risk (16.81%), and Regulatory Risk (7,233%), as shown in Figure 2.

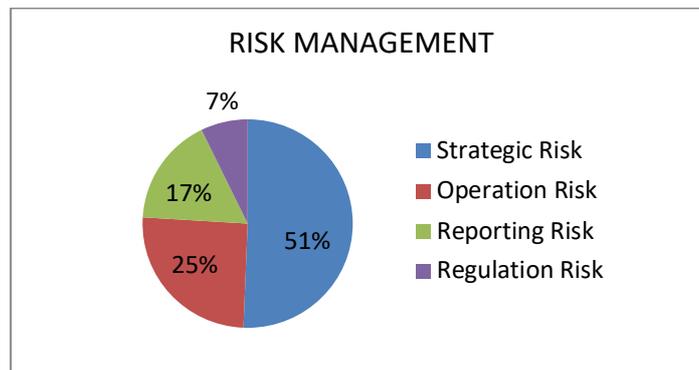


Figure2. Percentage of criteria in risk management

IV.1. Risk Prevention and Control

Based on the literature, studies obtained a list of preventions of each hazard and Risk. Respondents who were experienced in the field assessed whether the prevention was effective and common in the field. From the questionnaire results, risk prevention and control are as follows in Table 5.

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Table 5. The Risk Prevention and Control

	Risks	Risk Prevention and Control
Strategic Risk	S1	Provide quality data to add the functionality of the Company
	S3	Change the Company's paradigm to be adaptable to any changes.
	S2	Create products at competitive prices
	S4	Improve the management process
	S5	Provide limited access to the Company's sensitive data
	S6	Mitigate Risk for a major disaster
	S7	Research and allocate costs in order to compete in the market.
	S8	The Company has a competitive advantage.
	S9	Companies must have more product differentiation.
	S10	Make certain policies in order not to be contrary to the regulations.
	S11	Develop mature and accountable risk management
	S12	Create products or services that can satisfy the market
Operational Risk	O3	Relevant information making it easier to make the best decisions for the Company
	O1	Evaluate the Company's compliance and performance regularly
	O2	Evaluate resource capacity and maintain the balance of bookings
	O4	Create effective channels of communication within the Company
	O5	Create realistic, understandable, objective, and actionable performance measures
	O6	Create an organizational structure that can react positively and meets the business strategy
	O7	Minimizing the management of outsourcing activities involving third parties
	O8	Ability to obtain relevant and reliable reforms to support pricing decisions
	O9	Create efficient and effective corporate operations to achieve business objectives
	O10	Create conducive physical security and environment
	O11	Training knowledge, skills, career opportunities for key company personnel
	O12	Process resources properly to maintain a competitive advantage.
	O13	Minimize misconduct in financial statements and prevent misuse of assets
	O14	Management of physical, financial, or information assets to the relevant parties
	O15	Effective policies and clear limits on the authority
Reporting Risk	P1	The distribution of information is carried out by the authorities.
	P2	Evaluate other entities that are cooperation partners
	P3	Calculates liquidity and solvency ratios periodically.
	P4	Using the Company's funds effectively to generate optimal revenue
	P5	Provide accurate and complete information
	P6	Create a good system so that there is no manipulation of
	P7	Budgets and business plans are equipped with appropriate performance measures.
	P8	Create system protection and limited access

Regulation Risk	R2	Contingency liability account in anticipation of changes
	R3	Conduct business practices in accordance with the regulations
	R1	Continue to follow the development of the regulations.

V. CONCLUSION

Based on the analysis, the conclusion of this study is the need for big and immediate improvement of the Company's strategy. The result shows the strategic risk criteria have a very significant percentage of 51%. At the same time, the alternative in the Risk of strategies that must be fixed immediately is to Provide quality data to add functionality to add to the Company's functions and services (S1).

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